The life history of *Endophyllum Sempervivi* is peculiarly interesting because in that form the aecidiospores function as teleutospores. HOFFMANN finds that the binucleate basal cells arise from fusion of cells in the lower part of the aecidium. The axis of fusion, however, may lie in any direction, and there is no palisade-like arrangement of the fusion cells. The paired nuclei of the aecidiospore fuse and the subsequent processes are like those in teleutospores. The sporophyte phase is restricted to the aecidiospore mother cell and the two cells (aecidiospore and intermediate cell) formed from it.

In both of these forms the binucleate cells arise from the fusion of fertile cells, whose contiguous walls are dissolved. In this respect the process differs from the migration of nuclei through pores as described by BLACKMAN in his account of *Phragmidium violaceum*.

In a short note BEAUVERIE[23] reports further observations on the "corpuscules métachromatiques" which he finds in the mycelium of an unidentified rust of wheat and also in the host cells. The author now identifies these bodies with the "excretion bodies" of ZACH, and believes they remain in the host cells after the hyphae themselves have been digested.—H. HASSELBRING.

Embryo sac of Gunnera.—Ever since the investigation of *Gunnera* (Haloragidaceae) by SCHNEGG in 1902, the genus has been included with those interesting angiosperms (as *Peperomia*) displaying an excessive number of nuclei in the embryo sac preceding fertilization. It was very desirable to study the situation more critically, and this has been done by SAMUELS[24] for *G. macrophylla*. The sequence of events is as follows: The solitary hypodermal archesporial cell (mother cell) develops directly into the embryo sac, no tetrad in the ordinary sense being formed. At the first (heterotypic) division of its nucleus the reduced number of chromosomes was repeatedly observed to be 12. At the second division (four nuclei) two nuclei assume the micropylar polar position, and the other two are against the wall of the sac in the equatorial plane, and a little later move toward the antipodal pole. The polarity of the sac is thus attained at the 4-nucleate state. At this time the inner integument fuses to close the micropyle, and therefore the pollen tube was observed to pierce the integuments to reach the sac. The numerous vacuoles that appear during the second division fuse into a large central vacuole during the development of polarity. At the third division (eight nuclei) the upper one of the two micropylar nuclei divides to two nuclei side by side; and at the fourth division (16 nuclei) each of these two nuclei divides to two nuclei vertically placed. These four micropylar nuclei are the egg, the synergids, and the micropylar

[23] BEAUVERIE, J., La signification des corpuscules métachromatiques dans les cellules de céréales infestées par la rouille. Compt. Rend. Soc. Biol. **70**: 461–463. 1911.

[24] SAMUELS, J. A., Études sur le développement du sac embryonnaire et sur la fécondation du *Gunnera macrophylla* Bl. Archiv für Zellforsch. **8**: 53–120. *pls. 3–5. figs. 23.* 1912.

polar, not merely in position but also in function. The micropylar polar then fuses with the upper six nuclei toward the antipodal region, resulting in a fusion nucleus of seven nuclei; while the remaining six nuclei form the antipodal complex. The cells of this complex enlarge after the entrance of the tube, but after fertilization they degenerate.

Spermatogenesis was also followed, verifying the chromosome count, and showing a remarkable behavior of the pollen grain in frequently sending two tubes into the same style. Double fertilization was observed, so that the endosperm-forming nucleus finally becomes a fusion of eight cells.

SAMUELS discusses at length the relation of such a 16-nucleate embryo sac to the embryo sacs of gymnosperms. He also concludes that such a sac represents four megaspores in its origin.—J. M. C.

Paleobotanical notes.—In 1906 SCOTT published briefly the genus *Botrychioxylon*, and now there has appeared the full account.[25] The genus is of special interest in being a true fern (Botryopterideae) in which a stele of simple form "has advanced in the direction of substituting secondary for primary xylem." There is also anatomical evidence that it holds an intermediate position between Botryopterideae and Ophioglossaceae, thus linking the latter with the ancient ferns.

ARBER[26] has described a new species of the problematical genus *Psygmophyllum*, from the Lower Carboniferous of Newfoundland, and in a revision of the genus recognizes six species, distributed from Upper Devonian to Permian. As to the affinities of the genus, nothing can be determined in the absence of fructifications. There is a suggestive resemblance of the leaves to those of *Ginkgo*, but ARBER is convinced that the similarity is purely artificial. He associates the genus with other genera of the Paleozoic (as *Ginkgophyllum*, *Dicranophyllum*, etc.) as a distinct group under the name *Palaeophyllales*, which may or may not have been the ancestors of the Ginkgoales.

Dr. STOPES[27] has recorded the existence of angiosperms in the Aptian (Lower Cretaceous) of England, an earlier horizon than any in which angiosperms were known to occur. The specimens are in the collections of the British Museum of Natural History, and have been made the basis of the description of three new genera (*Aptiana*, *Woburnia*, *Sabulia*). The structure of the wood lends no support to the view that angiosperms arose from gymnosperms, since it is like that of high-grade angiosperms in all details. The wood

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[25] SCOTT, D. H., On *Botrychioxylon paradoxum*, sp. nov., a paleozoic fern with secondary wood. Trans. Linn. Soc. London II. Bot. **7**:373–389. *pls. 37–41.* 1912.

[26] ARBER, E. A. NEWELL, On *Psygmophyllum majus*, sp. nov., from the Lower Carboniferous rocks of Newfoundland, together with a revision of the genus and remarks on its affinities. Trans. Linn. Soc. London II. Bot. **7**:391–407. *pls. 42–44. fig. 1.* 1912.

[27] STOPES, MARIE C., Petrifactions of the earliest European angiosperms. Phil. Trans. Roy. Soc. London B **203**:75–100. *pls. 6–8.* 1912.